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The unknown acute toxicity of the antibiotic sulfamethoxazole

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Abstract

Background: Sulfamethoxazole (SMX) is one of the most used antibiotics in the last 50 years, applied to humans, veterinary medicines, and aquaculture purposes [1]. Detected in different environmental matrices this antibiotic can pose a risk to aquatic ecosystems and contribute to the spread of antimicrobial resistance [2,3]. In addition, SMX has already been included in the 3rd Priority Substances Watch List to be monitored in inland surface waters throughout the European Union under the Water Framework Directive [2]. Regarding the available literature, different studies report the toxicity of SMX to several aquatic organisms, however, these data are quite discrepant and incomplete. **Objective:** Evaluate the acute toxicity effects of SMX in aquatic model organisms from different trophic levels. **Methods:** Standard acute ecotoxicological assays were performed [4–7], evaluating the inhibition of the bioluminescence of the bacterium *Aliivibrio fischeri*, growth inhibition of microalgae *Raphidocelis subcapitata* and macrophyte *Lemna minor*, and immobilization and reproductive effects in the microcrustacean *Daphnia magna*. Additionally, sub-individual parameters were also evaluated in *L. minor* and *D. magna*. **Results:** Overall, the different species showed different sensitivities to SMX, where preliminary results revealed that *R. subcapitata* was the most sensitive organism. SMX was harmful to *A. fischeri* [EC_{50} (30 min) = 79.67 mg/L], and toxic to *L. minor* [EC_{50} (7d) = 2.11 mg/L; causing also lipid peroxidation]. In addition, was harmful to *D. magna* [EC_{50} (48h) = 68.75 mg/L], causing significant alterations in sub-individual parameters (e.g., neurotoxicity), and reproductive endpoints, namely a decrease in the rate of population increase at 45 mg/L of SMX. **Conclusions:** These results highlight the effects that SMX can cause in non-target organisms. Considering that the detection of SMX is increasing considerably in various environmental matrices, it is essential to continue monitoring the behavior of this antibiotic in the environment and its long-term effects on ecosystems.

Keywords: sulfamethoxazole; ecotoxicity; acute exposure; multispecies

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References

1. Ho, J.M.W.; Juurlink, D.N. Considerations When Prescribing Trimethoprim–Sulfamethoxazole. *Canadian Medical Association Journal* **2011**, *183*, 1851.
2. Cortes, L.; Marinov, D.,; Sanseverino, I.,; Cuenca, A.,; Niegowska, M.,; Rodriguez, E.; Lettieri, T., *Selection of Substances for the 3rd Watch List under the Water Framework Directive*; Luxembourg, **2020**.
3. Kovalakova, P.; Cizmas, L.; McDonald, T.; Marsalek, B. Occurrence and Toxicity of Antibiotics in the Aquatic Environment: A Review. *Chemosphere* **2020**, *251*.

4. OECD *Test No. 201: Freshwater Alga and Cyanobacteria, Growth Inhibition Test*; **2011**.
5. OECD *Test No. 221: Lemna Sp. Growth Inhibition Test*; **2006**.
6. OECD *Test No. 202: Daphnia Sp. Acute Immobilisation Test*; **2004**.
7. Microbics, M. *Microtox Manual - a Toxicity Handbook*; Microbics Corporation, **1992**; Vol. I–VI.